Laser Ablation Process for surface engineering of Current Collectors for Supercapacitor Applications

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Abstract

To achieve high power output of a supercapacitor, the interfacial electrical resistance between active materials and current collectors has to be kept as low as possible. Through using electrode materials of high electrical conductivity, using coatings of conductive thin films, and/or using large surface-area 3-D structure for current collectors, the contact resistance between active materials and current collectors can be significantly reduced and the utilization of active materials can be dramatically increased. The most common methods employed for surface etching of current collectors, however, are based on chemical or electrochemical processes. Those wet chemical processes have caused more and more environmental concerns and are limited by government regulations. Besides, wet chemical processes also leave unwanted chemical residuals on the current collectors which will affect long-term cyclic stability of the supercapacitor cells. In order to enhance active material retention and reduce contact resistance, we have developed a clean and environment-friendly process based on laser ablation process to create advanced oxide-free and highly conductive metallic current collectors that have large surface area with 3-D structure. We have tested those laser roughed stainless steel and aluminum current collectors in the Carbon-based aqueous symmetric supercapacitor cells and the advantages of laser treated current collectors will be demonstrated in this presentation.